DOCUMENT RESUME

ED 455 108 SE 065 054

AUTHOR	Hill, W. David; Bond, Sally L.; Wurtzel, Judy
TITLE	High Standards in Mathematics for Every Student: A Guide to the Effective Use of Resources.
INSTITUTION	National Council of Teachers of Mathematics, Inc., Reston, VA.
SPONS AGENCY	Department of Education, Washington, DC.; National Science Foundation, Arlington, VA.
REPORT NO	NSF-00-83
PUB DATE	2000-04-00
NOTE	48p.
PUB TYPE	Guides - Classroom - Teacher (052)
EDRS PRICE	MF01/PC02 Plus Postage.
DESCRIPTORS	*Academic Standards; Elementary Secondary Education; Mathematics Achievement; *Mathematics Instruction; Program Effectiveness; *Program Improvement; Resource Materials; Teaching Methods

ABSTRACT

In February 1998, the U.S. Department of Education (ED) and the National Science Foundation (NSF) developed and published a report called "An Action Strategy for Improving Achievement in Mathematics and Science" which laid out a series of strategies for improving achievement in mathematics and science. To facilitate the implementation of some of these strategies, the two agencies jointly funded a series of conferences focused on mathematics and invited each state to send a team. The purpose of these NSF/ED conferences was to rethink the use of federal formula funds (particularly Title I of the Elementary and Secondary Education Act) to support the implementation of high-quality, standards-based mathematics programs. These meetings brought together state and district administrators, including mathematics, Title I, and other federal program directors, to build mutual understanding of how to effectively use federal funds in support of a comprehensive mathematics improvement strategy. The guide is intended as a tool to help other state and district teams continue these conversations, and move conversation into action. This guide draws from and is designed to be read in conjunction with "Coordinating Resources To Support Standards-Based Mathematics Education Programs," a collection of district profiles from Horizon Research, Inc. These profiles describe how selected districts and schools are integrating federal, state, and local resources for a more coherent approach to mathematics education. As an adjunct to these district profiles, this guide contains sections addressing support for mathematics teaching and learning, the federal context for improving mathematics teaching and learning, a summary of what seems to matter in mathematics program improvement, and a self-assessment guide for analyzing a district's mathematics improvement efforts. Additional resources are identified in the appendix. (ASK)

Reproductions supplied by EDRS are the best that can be made
from the original document.

ED 455 108

High Standards in Mathematics for Every Student

A Guide to the Effective Use of Resources

U.S. DEPARTMENT OF EDUCATION
Office of Educational Research and Improvement
EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)
This document has been reproduced as received from the person or organization originating it.
Minor changes have been made to improve reproduction quality.
Points of view or opinions stated in this document do not necessarily represent official OERI position or policy.

By

W. David Hill
Sally L. Bond
Judy Wurtzel

BEST COPY AVAILABLE

High Standards in Mathematics for Every Student

A Guide to the Effective Use of Resources

By

W. David Hill
Sally L. Bond
Judy Wurtzel

Prepared with funding from the U.S. Department of Education and the National Science Foundation

National Council of Teachers of Mathematics • Reston, Virginia

Prepared with funding from the U.S. Department of Education and the National Science Foundation

Any opinions, findings, and conclusions or recommendations expressed in this publication are those of the authors and do not necessarily represent the official views, opinions, or policy of the U.S. Department of Education or the National Science Foundation.

Printed in the United States of America

UNITED STATES DEPARTMENT OF EDUCATION
NATIONAL SCIENCE FOUNDATION

April 2000

Dear Educators:

Far too many U.S. students finish high school without mastering the challenging mathematics necessary for success in the competitive knowledge-based economy of the 21st century. Ensuring that all students have an effective mathematics program requires a national effort to set high standards, teach a rigorous curriculum, and increase the number of highly qualified teachers of mathematics across the nation. Essential to these efforts is the coherent use of all the resources at our disposal -- federal, state and local resources -- to support comprehensive mathematics improvement efforts.

This publication, *High Standards in Mathematics for Every Student: A Guide to Effective Use of Resources*, focuses on how to effectively use federal resources, particularly Title I of the Elementary and Secondary Education Act, and state and local resources for mathematics improvement. It contains examples from school districts that illustrate the issues discussed, a self-assessment guide for analyzing a district's mathematics improvement efforts, and a variety of additional resources.

The Department of Education and the National Science Foundation have jointly developed this guide to reflect our collaborative work and our shared conviction that sustaining effective local mathematics improvement efforts requires flexible and thoughtful use of federal, state, and local resources. We encourage you to draw upon this guide and the successes of the profiled districts and schools to improve your district and school mathematics programs in order to help all children meet challenging standards in mathematics.

Yours sincerely,

Richard W. Riley
U.S. Secretary of Education

Rita Colwell
Director, National Science Foundation

Contents

Preface v

Acknowledgments ix

High Standards in Mathematics for Every Student: A Guide to the Effective Use of Resources 1

- Purpose of This Guide 2
- Support for Mathematics Teaching and Learning 2
- The Federal Context for Improving Mathematics Teaching and Learning 4
- Essential Elements for Coordinating Mathematics Improvement 6
- Summary 14
- Moving to Action: A Framework for Self-Assessment 15
- Who Are the Right People? 17
- How Can You Start the Conversation in Your State or District? 17

Appendix A • Dispelling the Myths: Background Readings 19

- Title I and mathematics Instruction: Making the Marriage Work 19
- Self-Assessment Guide for Improving Mathematics: Using Federal Resources for Improving Mathematics Teaching and Learning 24
- The Use of Title I Resources for High-Quality Mathematics Instruction: Myths and Realities 29
- Dispelling the Myths: Background Readings 30

Appendix B • Resources to Support Mathematics Education Reform from the Department of Education and National Science Foundation 31

National Science Foundation Funding Opportunities 31

U.S. Department of Education Funding Opportunities 33

Appendix C • Federally Funded Technical Assistance Providers 35

Implementation Centers 35

Appendix D • Additional Useful Resources 37

U.S. Department of Education Publications and Web Sites 37

Selected Additional Publications and Web Sites 38

Preface

This guide is the product of a joint venture between the U.S. Department of Education and the National Science Foundation to assist educators to more effectively use federal, state, and local funds to improve mathematics achievement. These two agencies funded the writing of profiles of five districts that had made strides toward coherent use of funds for mathematics improvement efforts, three regional meetings in fall 1998 that encouraged states and districts to make use of the lessons learned from these profiles, and the writing and dissemination of this guide.

The three regional meetings were intended to stimulate conversations about the effective coordination of resources in support of improving the mathematics achievement of every student in all states and districts. State and district teams were invited to attend. Three profiles were used as examples of how districts had successfully focused their schools on mathematics improvement and coordinated all their resources to support these efforts. Meeting participants studied and discussed the district profiles, and teams from these districts were present to bring more relevant detail to the discussions. Noted speakers were also invited to further stimulate the conversation in crucial areas.

In preparing this guide, the authors benefited from the district profiles (available at www.ed.gov/americacounts or www.ed.gov/pubs/math/), the conference speakers, and the conversations among conference participants, as well as from related research and literature. This guide was written to support the continuation and deepening of the conversation about mathematics improvement and the importance of the coordination of funds to support it.

About the Authors

W. David Hill, Deputy Director, Charles A. Dana Center at the University of Texas at Austin. Dr. Hill was one of the developers and facilitators of the regional meetings. His background is in public school administration. He is currently working at the Dana Center and as a consultant in Connecticut on the continuous systemic improvement of schools and school districts and the development of principals as instructional leaders.

Sally L. Bond, Consultant, the Program Evaluation Group in Pittsboro, North Carolina. As a Research Associate at Horizon Research, Inc., Ms. Bond coordinated the development of the district profiles and also served as a facilitator at the regional meetings for group discussions with the profiled district teams. Currently, she is an independent program-evaluation consultant and specializes in the evaluation of educational and social programs.

Judy Wurtzel, Executive Director, Learning First Alliance, in Washington, D.C. Ms. Wurtzel helped conceive and carry out this project as Director of America Counts, the mathematics initiative at the U.S. Department of Education. Currently, she is the executive director of a national coalition of twelve leading educational associations that have come together to improve student learning in America's public schools.

Acknowledgments

We, the authors, wish to gratefully acknowledge the contributions of the following people to the development and implementation of this project:

- John "Spud" Bradley of the National Science Foundation and Linda Rosen of the U.S. Department of Education for their work as representatives of the sponsoring agencies
- Marilyn Hala of the National Council of Teachers of Mathematics, who managed the project and made significant contributions to its content
- Iris Weiss of Horizon Research, Inc., for her leadership in the development of the district profiles
- Walter Secada of the University of Wisconsin-Madison and John Sutton of Mid-continent Research for Education and Learning for their support and advice

For their keen insights into the improvement of mathematics education programs and the effective coordination of local, state, and federal resources to support reform, we wish to thank the conference presenters:

- Gerald Tirozzi and Jim Kohlmoos, who were with the U.S. Department of Education at the time
- John Hunt of the National Science Foundation
- Heather Nelson of the Portland, Oregon, Public Schools;
- Marilyn Burns of M. Burns and Associates
- Uri Treisman and Joe Johnson, both of the Charles A. Dana Center at the University of Texas-Austin

And finally, for bringing key issues alive by sharing both their successes and their ongoing challenges, we especially wish to thank the district and school administrators who represented three of the profiled districts at the regional meetings:

- Sandra Lam and Dianne Meltesen of the San Francisco Unified School District
- Maria Gutierrez, Alice Davis, Susana Gonzalez, and Jana Garcia of the Ysleta Independent School District
- Dale Kalkofen, Charlene Parker, Marieta Harris, and Virginia McNeil of the Memphis City Schools

W. David Hill
Sally L. Bond
Judy Wurtzel

February 2000

High Standards in Mathematics for Every Student

A Guide to the Effective Use of Resources

Every student needs to understand and perform at a high level of mathematics to expand his or her available choices in life. Reading has long been recognized as the great equalizer of learning, but mathematics is historically the powerful sorter and selector of learning opportunities. According to national research, 83 percent of the students who take and pass first-year algebra and geometry go on to college; in contrast, of those students who do not reach that level of mathematics, only 36 percent go on to higher education. For low-income students the impact of failing to take these courses is even more pronounced; only 27 percent of the low-income students who did not take those courses go on to college.[1] Moreover, in our increasingly technological economy, knowledge of mathematics and science has become more necessary than ever before for success in the workplace. Education is an escape route for children in poverty, and mathematics opens the door to that route.

Following reports of the results of the Third International Mathematics and Science Study (TIMSS), improving the mathematics achievement of U.S. students, especially at the middle and high school levels, has risen to the top of the national agenda. President Clinton put mathematics improvement on his list of top educational priorities in the 1996 State of the Union speech. In that same year, Education Secretary Richard W. Riley moved mathematics onto his list of the top seven priorities for the U.S. Department of Education.

President Clinton recognized the importance of high standards in mathematics in a memorandum to the Secretary of Education and the Director of the National Science Foundation on 6 March 1997.[2] He wrote, "The first step in raising achievement is lifting expectations and setting high standards for what students should know and be able to do. TIMSS, our National Assessment of Educational Progress, and the standards developed by the National Council of Teachers of Mathematics give us a solid framework to build on."

Later in that same memorandum, the President directed the Secretary of Education and the Director of the National Science Foundation to develop a strategy that should "identify significant federal programs, activities, and partnerships available to improve teaching and learning, ensure that these resources are appropriately focused on helping students reach challenging math standards, and determine how these resources can best support state and local reforms."

The point is not for mathematics to supplant reading as our top educational priority. Rather, mathematics must now take equal billing with reading in education improvement efforts at the national, state, and local levels.

---

[1] "Mathematics Equals Opportunity: White Paper." October 20, 1997. U.S. Department of Education. Available at www.ed.gov/americacounts or www.ed.gov/pubs/math/.

[2] An Action Strategy for Improving Achievement in Mathematics and Science, U.S. Department of Education and the National Science Foundation, February 1998, p. A1-1. Available at www.ed.gov/americacounts or www.ed.gov/pubs/12TIMSS/.

Purpose of This Guide

In February 1998, the U.S. Department of Education (ED) and the National Science Foundation (NSF) developed and published a report, *An Action Strategy for Improving Achievement in Mathematics and Science,* which laid out a series of strategies for improving mathematics and science achievement.[3] To facilitate the implementation of some of these strategies, the two agencies jointly funded a series of conferences focused on mathematics and invited each state to send a team. The purpose of these NSF/ED conferences was to rethink the use of federal formula funds (particularly Title I of the Elementary and Secondary Education Act) to support the implementation of high-quality, standards-based mathematics programs. These meetings brought together state and district administrators, including mathematics, Title I, and other federal program directors to build mutual understanding of how to effectively use federal funds in support of a comprehensive mathematics improvement strategy. The guide that follows this brief introduction is intended as a tool to help other state and district teams continue these conversations and move the conversation to action.

This guide draws from, and is designed to be read in conjunction with, *Coordinating Resources to Support Standards-Based Mathematics Education Programs,* a collection of district profiles from Horizon Research, Inc.[4] These profiles describe how selected districts and schools are integrating federal, state, and local resources for a more coherent approach to mathematics education. As an adjunct to these district profiles, this guide contains sections addressing support for mathematics teaching and learning, the federal context for improving mathematics teaching and learning, a summary of what seems to matter in mathematics program improvement, and a self-assessment guide for analyzing a district's mathematics improvement efforts. Additional resources are identified in the appendix.

Support for Mathematics Teaching and Learning

The mathematics that we teach matters. Improvement efforts focused on a weak mathematics program, even if successful, will still produce students with substandard knowledge and skills in mathematics. TIMSS, NAEP, the NCTM standards, and other challenging benchmarks provide guidance for setting high expectations for student performance.[5] In the elementary school years, students should master arithmetic as well as basic concepts in other important areas of mathematics. In the middle grades, students should be expected to develop a deep understanding of important algebraic and geometric concepts as well as to extend their understanding of rational numbers, proportional reasoning, measurement, and data analysis. In high school, all students should be expected to pursue rigorous mathematics coursework, including trigonometry, and advanced topics, such as calculus, statistics, and discrete mathematics.

TIMSS, NAEP, and the NCTM standards also point to the importance of a focused curriculum that ensures that students gain a conceptual understanding of mathematics and the relationships among important mathematical ideas. Students should be able to think and reason mathematically, make interpretations, generalize, and use mathematics to solve unfamiliar problems. Implementing such a curriculum generally requires the careful selection of comprehensive mathematics instructional materials, as well as supplementary materials, that are linked to high standards.

---

[3]Ibid.

[4]Bond, Sally L., Boyd, Sally E., and Montgomery, Diana L. *Coordinating Resources to Support Standards-Based Mathematics Education Programs.* Chapel Hill, N.C.: Horizon Research, Inc., 1999. Available at www.horizon-research.com/public.htm.

[5]The newly revised *Principles and Standards for School Mathematics* from the National Council of Teachers of Mathematics is available at www.nctm.org/standards2000/. Sample items and results for the TIMSS and NAEP assessments can be found at http://nces.ed.gov/TIMSS/ and http://nces.ed.gov/nationsreportcard/site/home.asp, respectively.

Conscious and deliberate efforts to set high standards are particularly important in high-poverty districts and schools. Research has shown that instruction for students in these schools often emphasizes low-level knowledge and skills and is often provided by unqualified or underqualified teachers. For example, although the long-standing performance gaps in mathematics among white, black, and Hispanic students at all grade levels on the NAEP has been narrowing over time, substantial performance differences remain in tasks that assess conceptual understanding, mathematical reasoning, and problem solving.[6]

If schools are to raise expectations for their students in mathematics, district leadership must collaborate with the community to develop and clearly communicate a unified vision and related goals. Principals are key at the school level. They must build a system of support for teacher and student learning in mathematics. But leadership at the district and principal levels is not enough. Teachers must also hold themselves accountable for their students' learning. Teachers must understand and accept high expectations for themselves and for their students, take the responsibility to implement district and school curricula, and report student progress to parents. High mathematics standards for student performance will not be achieved until teachers understand the standards and accept responsibility for preparing their students to meet them.

Challenging Standards for Students

Marilyn Burns, a noted mathematics educator who spoke at two of the NSF/ED conferences, provided an example of what high standards mean in the area of arithmetic. First, she pointed out that the arithmetic that students should master in school includes—but is broader than—accurate and efficient addition, subtraction, multiplication, and division. It should also include problem solving and number sense. For example, a student who has mastered these basic arithmetic skills will be able to—

1. identify the operation called for in the problem situation, including situations that are new to them;
2. choose the numbers to use;
3. do the calculation, using the appropriate method (mentally, with paper and pencil, with a calculator);
4. evaluate the reasonableness of the solution and make a decision on the basis of the answer.

A crucial element of this effort is therefore ensuring that teachers have access to high-quality instructional materials and the knowledge and skills to effectively teach a more rigorous mathematics curriculum. Research on effective professional development suggests that six characteristics typify high-quality professional development that is associated with student achievement gains.[7] High-quality professional development—

- provides a clear image of teaching and learning that embraces high standards for all students;
- focuses on deepening teachers' knowledge of content and of how students learn specific content, such as curriculum-focused professional development;
- provides extended, in-depth learning opportunities for teachers that are embedded, whenever possible, in real classroom teaching experiences at their schools;
- supports expanded roles for teachers as leaders and colleagues, such as mentors, peer coaches, and designers;
- links to an educational system's programs and standards;
- is accountable for achieving results in terms of teaching and learning.

[6] Silver, Edward A. *Improving Mathematics in Middle School: Lessons from TIMSS and Related Research*. Washington, D.C.: U.S. Department of Education, 1998. Available at www.ed.gov/inits/math/silver.htm.

[7] Planning and Evaluation Service, U.S. Department of Education. *Federal Education Legislation Enacted in 1994: An Evaluation of Implementation and Impact*. Washington, D.C.: Author, 1999. See also American Institutes for Research. *Designing Effective Professional Development: Lessons from the Eisenhower Program*, Washington, D.C. Both are available under "Publications and Products" at www.ed.gov.

Effective preservice teacher education and in-service professional development, when they embody these characteristics, help enable teachers to take high standards and make them real in the classroom.

The federal government has made a significant investment in supporting states and localities in their efforts to adopt challenging standards and to prepare teachers to implement them. The next section of this guide describes in more detail the nature of federal support for standards-based mathematics education.

The Federal Context for Improving Mathematics Teaching and Learning

Resources have long been available from the U.S. Department of Education and the National Science Foundation to support mathematics improvement programs. Historically, however, federally supported improvement efforts in mathematics have often been disjointed from one another and from the state and local programs, of disappointing quality, short term, or otherwise hard to sustain. Recent changes in federal laws help to address these shortcomings.

Historical Challenges

- NSF's competitive grant programs for improving mathematics and science education have spurred some exemplary reform efforts. However, sustaining these reforms once grant funding ends has been challenging for states and districts.
- The Department of Education's support for improving mathematics education is chiefly through large-scale, flexible, long-term formula grants to states and districts to enable all students to meet high standards in the core academic subject areas. Despite the strengths of these programs, the quality of mathematics instruction and professional development provided through them has not been sufficient. Title I of the Elementary and Secondary Education Act, which at over $7 billion is the largest federal investment in K–12 education, has given inadequate attention to high-quality mathematics.
- The Eisenhower Professional Development program, which emphasizes mathematics and science, has not successfully deepened knowledge of mathematics and science content or provided extended, in-depth learning opportunities for a majority of teachers participating in Eisenhower activities. A recent evaluation of the Eisenhower Professional Development program found that districts that cofund and coplan their Eisenhower activities with other federal

Additional Resources

The appendix of this guide contains the full text of several resources produced by the Department of Education, in consultation with NSF, that are intended both to dispel common myths and to make the case for using Title I and other ESEA resources as integral elements of a mathematics improvement strategy.

1. **"Title I and Mathematics Instruction: Making the Marriage Work."** This article by Mary Jean LeTendre, Director of the Title I program, gives specific examples of how Title I might be used as a key resource in building quality mathematics programs (pp. 19–23).
2. **Self-Assessment Guide for Improving Mathematics.** This tool is intended to assist administrators in thinking creatively about use of federal resources for mathematics (pp. 24–28).
3. **The Use of Title I Resources for High-Quality Mathematics Instruction: Myths and Realities.** These overhead transparencies succinctly dispel common myths about the use of Title I funds to support mathematics improvement. They were presented at the regional ED/NSF conferences by then Assistant Secretary of Elementary and Secondary Education Gerry Tirozzi and by then Deputy Assistant Secretary of Elementary and Secondary Education Jim Kohlmoos (pp. 29–30).

programs are more likely to offer Eisenhower activities of high quality. However, although coplanning and cofunding between Eisenhower activities and NSF's systemic initiatives often occur, only 50 percent of school districts cofund Eisenhower and Title I activities, and coordination with Title I appears superficial in many districts.[8]

Opportunities for the Improved Use of Resources

Since the mid-1990s, there have been substantial opportunities to improve the way states, districts, and schools use federal resources in the context of their mathematics improvement efforts and to marry the best knowledge learned from reform efforts with the sustainable use of formula grants. With the reauthorization of ESEA in 1994, a new emphasis on high standards and flexibility removed the restrictions from Title I and other ESEA funding sources that had effectively discouraged the coherent use of funds. (For background information on these issues, see Title I and Mathematics Instruction in the appendix).

ESEA now provides a framework and tools for developing a coherent mathematics program that includes consolidated state and local planning, the consolidation of state and local administrative funds, and the expansion of schoolwide programs that allow high-poverty schools to blend funds to create programs that address their particular needs. Examples of the kinds of flexibility provided by ESEA follow:

- Schools with more than 50 percent of students living in poverty qualify to implement schoolwide Title I programs and may choose to consolidate funds from Title I and several other programs to better serve all students in the school.
- Title I schools still operating as targeted assistance programs have significant flexibility for serving migrant, preschool, neglected, delinquent, homeless, and limited English proficient (LEP) students.
- The Technology Literacy Challenge Fund (in Title II of the ESEA) ties funding for technology to long-range state and district plans.
- Waivers of most ESEA program requirements are available to states and districts when statutory and regulatory requirements hinder innovation and improvement efforts.

Moreover, the 1997 reauthorization of the Individuals with Disabilities Education Act (IDEA) became an additional impetus for developing challenging mathematics programs for all students. The first twenty years of implementation of IDEA effectively moved many disabled students into school. However, far too many students were offered a separate low-level, dead-end curriculum. The 1997 reauthorization of the IDEA significantly increased the focus on the academic achievement of students with disabilities and their access to challenging curriculum. Among the significant changes in the reauthorization are (1) a requirement that each child's individual education plan address how special education will enable the child to be involved in and progress in the general education curriculum; (2) a requirement that, with very few exceptions, students with disabilities be included in state and districtwide assessments; and (3) a provision allowing IDEA funds to be included in schoolwide projects. The result of these changes is to hold schools accountable for the progress of students with disabilities toward the standards they have for all students in the core academic areas, including mathematics.

As this guide goes to press, the subsequent reauthorization of ESEA is under way.[9] The Administration's proposal continues to emphasize on high standards and flexibility, while providing new opportunities for improving mathematics instruction, including support for the kind of sustained, intensive, and collaborative professional development that teachers say, and that research shows, most improves their teaching. Regardless of the eventual specifics of the reauthorization, substantial opportunities to garner federal resources in support of coordinated, effective mathematics improvement efforts will continue.

[8]Ibid.

[9]For additional and updated information on the reauthorization of ESEA, see www.ed.gov/offices/OESE/ESEA.

Myths and Realities

A major barrier to making the best use of federal funds for mathematics improvement is often a lack of knowledge. Even though ESEA was substantially changed in 1994, many local communities continue to harbor misconceptions about how federal funds can be spent.

- For example, a common myth is that Title I can be used to support instruction only in reading and language arts. However, Title I can be used for instruction only in mathematics. Indeed, the Title I law requires educators to hold Title I schools accountable for the success of their students in achieving high standards in mathematics as well as in reading.
- Another common myth is that Title I funds can be used only to support instruction. However, the law makes clear that Title I can be used for a wide range of activities—including upgrading curriculum and instructional materials, offering ongoing professional development, providing continuing education for paraprofessionals, extending the regular school day, and increasing parent involvement activities—focused on improving the achievement of students participating in Title I.
- A third common myth is that professional-development activities funded by Title I or Title II are limited to courses or seminars. In fact, ESEA encourages in-depth, long-term, sustained, collaborative professional development that emphasizes deep content knowledge and reflection on classroom practices and is coordinated with other aspects of reform.

The bottom line is that federal funds do not prevent districts and schools from effectively serving their students' mathematics needs. At the same time, it is likely that rising expectations for ESEA programs increasingly will require district and schoolwide mathematics improvement efforts to be research-based, standards-driven, coherent, and accountable for results.

The Importance of State Policy

Although this guide focuses on the district context for mathematics improvement efforts, there is a growing recognition that "state policy matters," according to Uri Treisman, Director of the Charles A. Dana Center at the University of Texas at Austin. Treisman spoke at two of the conferences where he argued that the Third International Mathematics and Science Study (TIMSS) contains an important lesson for the United States. If we examine the TIMSS's results closely, we find that students from some states perform as well in mathematics as students in the highest performing countries, whereas students in other states perform at the bottom of the international comparisons. The important question is, Why do those differences exist?

According to *Exploring Rapid Achievement Gains in North Carolina and Texas* (available at www.negp.gov/reports/grissmer.pdf), at least part of that difference is based on the accountability system of the state. States that hold the schools accountable for the performance of all their students, such as North Carolina and Texas, are experiencing improved performance for all students and a closing of the gap between the lowest and highest performing students.

Some states have created organizational structures or committees to intentionally network state mathematics leaders with the state-level coordinators of Title I and other federal programs. Through their example, and with their guidance, many of the schools in these states have found creative, effective ways to use federal dollars to support schoolwide mathematics improvement efforts.

Treisman proposed challenging goals for states and districts. The quality of a child's education should not depend on geographic location, and we should not be able to predict a student's performance from the conditions of his or her life.

Essential Elements for Coordinating Mathematics Improvement

At the request of the National Science Foundation (NSF) and the Department of Education (ED), Horizon Research, Inc., developed profiles of five school districts that were effectively

using ESEA, NSF, state, and local resources in a coherent way to support mathematics improvement efforts. These districts also had devised interesting mechanisms for coordinating local, state, and federal resources and were taking advantage of the new flexibility in Title I to support their mathematics education improvement programs. The five districts also varied in size, geographical location, and state policy context.[10] They were studied as examples of a small number of districts that were making progress toward educating all their students to high levels of achievement in mathematics through the coordinated use of federal, state, and local funds.

On the basis of our experience of identifying districts for these case studies, we believe that very few districts nationally are as far along as the ones that we profile in terms of sophisticated and coherent use of ESEA, NSF, and other state and local funds. We believe, therefore, that these profiles are helpful because in addition to demonstrating success, they exhibit common themes that can be instructive to other districts as they rethink how they are organized to make decisions about the optimal blending of resources to serve all students.

All five district profiles are the subject of a recently published report from Horizon Research, Inc., titled *Coordinating Resources to Support Standards-Based Mathematics Education Programs.*[11] Three of these district profiles (Memphis (Tenn.) City Schools, San Francisco (Calif.) Unified School District, and the Ysleta (Tex.) Independent School District) were used to stimulate analysis and discussion at the conferences.

Looking across the district profiles, the authors of the Horizon report identified four overlapping phases related to improved resource coordination in the context of mathematics improvement efforts:

- Establishing a shared vision of high-quality mathematics education that is reflected in challenging academic standards for all children in the district
- Coordinating resources by assessing student performance and needs relative to the district's vision for high-quality mathematics, developing strategies to increase student achievement, and consolidating appropriate resources to implement those strategies
- Supporting schools to implement standards-based curriculum, instruction, and assessment practices in mathematics that result in increased student achievement
- Sustaining school efforts and accomplishments toward the continued improvement of student achievement in mathematics

In reality, it is artificial to view each phase as a distinct step in the reform process. As the profiled districts moved through their mathematics improvement efforts, they did not approach each phase in a rigidly ordered, step-by-step fashion. Rather, the districts recognized these phases as interlocking pieces of a puzzle that needed to fit together for coherent reform to occur. Nevertheless, by looking at each piece individually, educators in other districts can use the four phases as reference points in an analytical framework to help them assess the strengths and weaknesses of their own programs.

Crucial elements clearly emerged within each phase, and the importance of these elements was confirmed by the experiences of the conference participants. On the basis of current research and practice wisdom, we advise users of this guide to attend to each of these elements in their program improvement efforts.

---

[10]The five districts that were profiled by Horizon Research, Inc., range in size from 6 000 to 200 000 students. They are located in the Northeast, Midwest, Southeast, Southwest, and West Coast. Key variables in the state policy contexts of these districts include the development and implementation of statewide curriculum standards, standards-based testing programs, and district accountability systems.

[11]Bond, et al., 1999. Available at www.horizon-research.com/publications/coord_resources.pdf.

Establishing a shared Vision

A shared vision—

- applies to all students;
- begins with challenging academic standards;
- is established through collaboration;
- requires a long-term commitment.

This phase of improving mathematics achievement in a district is fundamentally about raising expectations for every child in the community. It is no longer acceptable, and certainly not inevitable, that the children of the rich will achieve while those of the poor will languish. Increasing numbers of districts, including those in the district profiles, are demonstrating that it is possible for virtually all students to meet high standards.

In each of the profiled districts, a shared vision was built on high standards in mathematics. The districts worked from national and state standards to develop rigorous curricula and to select challenging instructional materials. Building from standards provided the first level of assurance that the mathematics being taught was worthwhile for students to learn and would prepare them to have choices in postsecondary education, careers, and life.

Even in districts where the vision of excellence for all originated with the superintendent, that vision could not have been sustained without considerable collaboration and trust across many layers of the education system. District leadership played a crucial role in planting the idea that expectations should be raised for all children and in addressing the concerns that were raised by educators and other stakeholders in their communities. They also gave these parties opportunities to work together to craft ambitious but realistic plans for achieving the vision.

Agreeing on standards, persuading stakeholders that all students can achieve at high levels, collaborating on the development of districtwide improvement plans—all of this takes time. It also takes time for the fruits of these labors to reach the classroom level where students strive to achieve at higher levels than ever before. For this reason, a system and its leaders need to make a long-term commitment to the process of establishing *and operationalizing* a shared vision. At the time these cases were prepared, the profiled districts had been in the process of reform for a number of years and, to varying degrees, were able to report

A Vision of Excellence for All

The superintendent of the Ysleta Independent School District made improving student achievement non-negotiable and publicly stated the district's vision as "every student who enrolls in our schools will graduate fully bilingual and prepared to enter a four-year college or university." Establishing high expectations for all students is already paying off for Ysleta ISD. Through the state accountability system, the district was the "first and only" urban district to be recognized in 1997–98 for high levels of student achievement.

From *Coordinating Resources to Support Standards-Based Mathematics Education Programs* (Bond, Boyd, and Montgomery 1999)

Opportunities for Collaboration

In Memphis, the district's mission statement and goals grew out of a mammoth communitywide effort soliciting input from professional staff, members of the board of trustees, parents, business people, and other members of the community. With the help of an external facilitator who had strategic-planning expertise, focus group discussions were held throughout the community to solicit input from parents, business people, the Board of Education, and central office staff. The external consultant then worked with district administrators to translate broad community consensus into strategic-planning goals and lifelong-learning standards. With these goals and standards to guide them, the superintendent and her executive staff developed a districtwide action plan and performance indicators, which were subsequently approved by the Memphis City Board of Education.

From *Coordinating Resources to Support Standards-Based Mathematics Education Programs* (Bond, Boyd, and Montgomery 1999)

some improvements in student achievement. After three or four years, they had made substantial progress, but they had not yet achieved their goals.

Everyone agreed that there are no short-term fixes or silver bullets to make sustainable changes in the system. As the Memphis superintendent put it, "It takes a lot of time to think you could have student success, to change the culture of an organization, because people don't believe it can happen. You have to stay long enough to make them believe." The other two districts, San Francisco and Ysleta, should be good test cases of the importance of long-term commitment. After leading substantial mathematics improvement efforts in their districts, the superintendents in these two districts are now gone. It will be important to watch these two systems to see whether the new district leaders maintain the vision and goals of the previous administrations. Furthermore, it will be instructive to see whether support for high expectations in mathematics for all students and the crucial elements of achieving that ambitious goal are deep enough *in the system* to sustain student achievement gains in the face of changes in district leadership.

Coordinating Resources

The effective coordination of resources is facilitated by—

- prioritizing needs on the basis of an analysis of appropriate data;
- developing a "real" district plan for change;
- reorganizing central office staff;
- taking full advantage of flexibility in the use of federal funds.

The district profiles suggest that the coordination of resources is a complex process, which involves people with content and program knowledge, expertise, and responsibility working closely together to achieve common goals.

The first steps in determining how to use resources most effectively are identifying and prioritizing needs. Needs are determined by analyzing existing data (e.g., on mathematics achievement, course-taking patterns, graduation rates) and comparing current performance with the district's vision for what students should know and be able to do, and in what time frame. Further, to better understand how to effectively serve all students, the profiled districts disaggregated their data by subgroups in the student population to identify their specific needs and monitor their progress relative to other student groups.

The identified needs for all students and for subgroups of students form the basis of district plans for mathematics improvement. A comprehensive plan translates the vision for higher achievement in mathematics into a coherent program of challenging curriculum, district assessment, professional development for teachers, consistent and aligned policies, a structure for supporting schools to effectively implement the plan, and additional instructional support for students who are having difficulty meeting district expectations for high achievement. Sometimes hard decisions must be made to make the district's vision a reality. For example, in all three profiled districts, remedial mathematics courses were removed from the high school curriculum; every student was required to take algebra and at least two other college-preparatory courses for graduation.

Using Disaggregated Data

In Ysleta ISD, student performance data is disaggregated for Hispanic, African American, white, and low-income students, as well as other important subgroups. Schools are held accountable for the achievement of each subgroup, and the school's state accountability rating is based on the lowest-performing group. Site-based management teams at the schools are responsible for using student achievement data and the district's plan to design a standards-based instructional program and to allocate the funds to support it.

From *Coordinating Resources to Support Standards-Based Mathematics Education Programs* (Bond, Boyd, and Montgomery 1999)

Innovative Uses of Funds

In the profiled districts, decisions about how to use resources to achieve academic improvement goals are made increasingly at the school level. Title I and other funds are allocated to the schools and decisions about how to use those funds are made by the school improvement councils. In San Francisco USD, about 88 percent of the $11 million of Title I funds go directly to schools. In Ysleta, about 85 percent of Title I funds go to the schools, and in Memphis, 85 to 90 percent of the Title I funds go to schools.

Different from the way that they typically use Title I, these districts and schools have used their Title I funds to support essential elements of an overall district improvement plan for challenging, standards-based mathematics. These schools tend to use a significant amount of Title I funds for professional development and for purchasing the new instructional materials needed to carry out district improvement plans. Rather than tie up their money in personnel, schools are encouraged to spend a significant proportion on innovative strategies and materials.

From *Coordinating Resources to Support Standards-Based Mathematics Education Programs* (Bond, Boyd, and Montgomery 1999)

High-priority needs, a comprehensive plan, and knowledge of the regulations attached to specific funds built the framework against which the profiled districts considered how to apportion available resources. Traditionally, these decisions have been made within the administrative structures of each funding source. The result has been a fragmented approach to resource use. Each profiled district reorganized its central office staff so that the persons responsible for directing K–12 instruction, Title I, Bilingual Education, Eisenhower, and Special Education programs had the time to meet regularly to work together to coordinate and consolidate their plans, programs, and funding. In some cases, this reorganization led to increased collaboration in the implementation of programs, which further enhanced the consistency of the mathematics program.

As fund coordinators began to meet together regularly and talk over common needs and plans, they also identified priority goals and strategies in the district plan. Over time, they began to view and use their resources collectively. Title I and other fund coordinators made themselves aware of new flexibility in the laws governing the use of federal funds. Once they found that they were no longer limited by traditional uses of federal funds, they were able to address district needs in more creative ways—in effect, "thinking outside the box"—to develop and fund a coherent program that targeted the highest-priority needs in their districts. This same philosophy was then passed along to the building level, where school improvement councils were able, for the most part, to treat their mix of funds as a single pot of money to address their schools' specific needs.

Supporting Schools

Crucial mechanisms for supporting mathematics improvement at the school level include—

- central office support;
- data-informed decision making;
- real school improvement plans;
- continuous learning.

This phase of mathematics program improvement is focused on supporting systemic change at the school level. The district profiles illustrate the essential role played by central office staff in developing the capacity of school personnel to translate their high expectations for students into reality.

District leadership must maintain a balance between holding schools accountable for results and allowing them the flexibility to determine how the results will be achieved. The district cannot simply set the goals, hold the schools accountable, and step away to monitor the results. District staff must also play the crucial role of actively supporting the school in

analyzing school-level data, developing a plan of action, removing the barriers to successful implementation of the plan, and providing technical assistance.

To effectively promote mathematics improvement in the schools, the district office must change its role from *directing* school change through edict and memorandum to *supporting* school change by removing barriers to the school's ability to successfully focus on improving student learning. District office staffs are transformed from compliance monitors to service providers. The district staff is in the schools, working side by side with the school staff to analyze data, make informed decisions, solve problems, model effective practice, and find resources. Central office staff stay current on best practices in mathematics and make sure that schools have access to that information. For example, mentor teachers are on-site to follow up on professional-development activities with teachers. They observe in classrooms and advise teachers on instructional practices. Central office personnel attend school improvement planning meetings to share ideas and help solve problems. In such situations, the image of the district office transforms from being perceived as a barrier to change to being a valued colleague and a crucial partner.

Successful schools are driven by decisions based on a careful analysis of data on student performance and related issues. They examine an array of data disaggregated by the important subgroups of students in their school so that they know the impact of the mathematics program on every student. For example, they might find that seventh grade students do not demonstrate proficiency in geometry concepts. Therefore, teachers need to analyze all the factors (curriculum, teachers' knowledge of content, whether geometry was taught, mobility and attendance of students in the classroom) that might relate to that particular deficiency before determining the appropriate course of action.

Providing Professional Support to Schools

All three districts independently developed a common strategy to use teachers on special assignment to support school improvement.

In Memphis, the district's mathematics infrastructure consists of a Mathematics Facilitator and ten Teachers on Assignment. This team is responsible for professional development for all elementary and secondary mathematics teachers. To further support mathematics improvement efforts, the district has identified a mathematics Lead Teacher in every school in the district. The Lead Teacher is trained by the facilitator and Teachers on Assignment and is responsible for supporting teachers in learning the new knowledge and skills in their own schools.

San Francisco USD has ten Teachers on Special Assignment (TSAs), who facilitate change in school mathematics programs. As a district mathematics improvement team, the TSAs works with Lead Teachers in the schools to develop assessment tasks that are aligned with their curriculum and textbooks, to inform and improve classroom instruction, and to give teachers with the opportunity to examine student work.

Ysleta ISD uses a team of eleven Mentor Teachers, funded through an Urban Systemic Initiative (USI) grant from the National Science Foundation, to facilitate mathematics curriculum implementation in Ysleta schools. Each Mentor Teacher is assigned to specific schools, where he or she serves as a resource to help mathematics faculty align their chosen curriculum with the state and regional standards.

From *Coordinating Resources to Support Standards-Based Mathematics Education Programs* (Bond, Boyd, and Montgomery 1999)

The information garnered through this kind of research and data analysis is used to develop real school improvement plans—"real" in the sense that data analysis and research influence decisions; planned actions reflect a consensus of the school community; school resources are focused on the goals of the plan; and plans guide the daily actions of the staff. In the profiled districts, most schools that were eligible to be schoolwide projects took advantage of the opportunity to thoughtfully consolidate ESEA and other funds in support of their improvement plans.

Data-Informed Planning and Decision Making

In San Francisco, schools are the locus of decision making on how to use Title I funds to support mathematics. Each school has a School Site Council, sometimes chaired by principals but usually by parent and teacher cochairs. At the elementary and middle schools, School Site Councils are made up of parents and school staff; students are also included in the mix in middle and high schools. School Site Councils meet at least monthly, engaging in an ongoing cycle of planning, implementing, monitoring, and assessing site-based activities aimed at meeting district and school priorities. To develop School Site Plans, the Council uses both quantitative and qualitative data (e.g., achievement scores and documentation of site-based professional development). In making policy and budget decisions, the School Site Council receives input and suggestions from instructional staff; a Bilingual Advisory Committee, comprising parents of English Language Learners; and a School Advisory Committee, composed of other parents or community members.

From *Coordinating Resources to Support Standards-Based Mathematics Education Programs* (Bond, Boyd, and Montgomery 1999)

For schools to develop the capacity to support all students in meeting high standards in mathematics, every member of the school staff must engage in a continuous learning process. For teachers, this means a continuous study of mathematics content, pedagogy, and assessment. For administrators, it means a focus on improving their instructional leadership skills. For both, it means placing a priority on the learning of students, or, more specifically, on finding ways to support every student in reaching the standards.

With district support, successful schools have rethought the way that they engage in professional development. No longer do they think of professional development as "going to a workshop." Their expanded view of professional development is of an array of learning experiences, often tied to the implementation of high-quality instructional materials, that includes planning and problem solving together, participating in study groups, examining student work, or visiting one another or another school. Teachers learn every day from one another, from others, from experts, and from research. Their learning is focused on understanding what it takes to support their students in making daily progress toward meeting the expectations of the mathematics standards.

Keys to Effective Title I Schools

Joe Johnson, Program Director of the Texas Comprehensive Technical Assistance Center at the Charles A. Dana Center, spoke at the Denver conference. His central message was based on studies of effective Title I schools and districts in Texas. The first study was of twenty-six Title I schools in Texas whose students performed on the state mathematics test well above the level traditionally expected of poverty students and at levels comparable to students in wealthy suburban districts. The study found a number of common traits in these schools: a focus on student achievement, an attitude of no excuses for low student performance, an inclusive school culture, a sense of family, a risk-free environment, and a passion for learning.

Successful Texas Schoolwide Programs: Research Study Results (February 1997) can be found at www.starcenter.org/promise/research.htm.

Johnson also reported how, on further examination of the successful schools, researchers found the majority of the schools clustered in a few of the 1000+ school districts in the state. A study of these effective districts followed. The early results of this ongoing, in-depth study revealed three common themes in these districts:

- *A sense of urgency*—conveys the conviction that the community desires and expects high academic achievement for all students.
- *Responsibility*—is the commitment shared by the community and the schools to meet those high academic goals.
- *Efficacy*—is the power to produce the desired effect of high academic achievement.

Urgency, Responsibility, Efficacy: A Study of Successful Texas School Districts can be found at www.starcenter.org/pdf/urgency.pdf.

Sustaining Improvement

To sustain mathematics improvement—

- everyone involved in educating children must be accountable for results;
- school and district policy must be aligned with high standards and high expectations for all students;
- a nurturing and supportive community is essential;
- students receive additional support as needed.

The profiled districts understood that small incremental changes do not reach all students. If the goal is to be achieved by all students, then change must be fundamental and systemic. No excuses can be accepted for any subgroups who may have difficulty reaching the goal. Everyone in the system must come to believe that virtually all students can meet the goals. They must also become invested in finding ways to help all students achieve those goals.

Sustaining school improvement, as measured by substantial increases in mathematics achievement for all students, involves driving fundamental changes deep into the system. For all students to meet high standards in mathematics, improvements in the educational system at the school and district levels must transcend the work of a single leader (or group of leaders) and reside in the beliefs of the professional and lay communities. The profiled districts encouraged changes in the system and in the beliefs of individuals by holding the schools and school personnel accountable for improving student learning. School plans were examined in terms of the likelihood that they would produce results, and principals were evaluated in large part on the basis of the increases in student performance in their schools. Schools that produced results were given greater autonomy; those that did not show improvement came under increased scrutiny and were given priority attention.

Holding Schools and School Personnel Accountable

Ysleta ISD schools are accountable to the district and the state for achieving results on the state tests in reading, writing, and mathematics. Student-performance data are disaggregated for Hispanic, African American, white, and low-income students. School-accountability ratings are then based on the achievement of the lowest-performing student group. To further challenge schools to serve all students well, data used to calculate school accountability ratings will soon include state test results for bilingual and special education students.

In Memphis City Schools, principals are evaluated every three years as part of the state's Principal Performance Evaluation Program (PPEP). Though ostensibly focused on principals, PPEP is currently the mechanism by which schools are held accountable for improvement. The program tracks four kinds of school performance indicators: quality of the School Improvement Plan, principal efficacy, positive school climate, and growth in student achievement.

From *Coordinating Resources to Support Standards-Based Mathematics Education Programs* (Bond, Boyd, and Montgomery 1999)

Deep system change also depends on aligning crucial components of the teaching and learning system—curriculum, instruction, and assessment—to the mathematics standards. The case study districts understood that true alignment occurs when teachers understand the standards and use them to plan daily instruction for their students. These districts used the standards as a guide in selecting textbooks and other instructional materials, planning professional development, and selecting and developing appropriate assessment instruments. They also brought district policies into alignment with the standards by taking such actions as eliminating low-level mathematics courses from the curriculum and making high school work in algebra and algebraic thinking accessible for all students.

A community's trust and support of its schools must be nurtured to be sustained. The broader school community is a constantly changing environment. New families move in,

political views shift, and leadership changes. District leaders must stay in constant contact with the community: providing information about progress toward the goals, sharing success and failure, listening to community questions and concerns, and reaching more and more individuals. Attention must be given to nurturing the understanding and support of the professional as well as the lay community. Principals and teachers are key district leaders in developing and sustaining the trust of the community. Key leaders in the business community can be a crucial buffer and a stabilizing force in supporting the educational system through leadership changes. For all members of the community, support for the district's mathematics program is based on a personal understanding of the district goals and standards for its students.[12]

Additional Support for Students in Need

In San Francisco, the district has allocated funds that enable all middle and high schools to extend the school day with an additional class period to give students more preparation for college-preparatory mathematics classes. The class "provides the scaffolding" that students need to succeed. The district has also budgeted additional funds to secondary schools for student support services, such as before- and after-school tutoring and Saturday programs.

From *Coordinating Resources to Support Standards-Based Mathematics Education Programs* (Bond, Boyd, and Montgomery 1999)

The students themselves cannot be overlooked in this improvement effort. Without a support system in place for students, they will become the victims of system change rather than its beneficiaries. In the short term, most students will not have the full benefit of coming up through the improved mathematics program. Along the path to graduation many will encounter raised expectations that they are unprepared to meet. However, from the experience of the profiled districts, with the scaffolding of supports such as summer academies, Saturday Schools, and targeted tutoring, virtually all students can meet high standards in mathematics.

Summary

The stakes for improved performance in mathematics are getting higher on several fronts in terms of personal preparation for work and adulthood and in terms of our nation's broader economic interests. Academic expectations of students and teachers are being raised as national organizations and experts define challenging standards for performance in mathematics, such as the mastery of the fundamentals of algebra and geometry by the end of eighth grade.

States and localities have numerous resources available to them to support mathematics improvement efforts—including Title I, Eisenhower, NSF, and IDEA funds. Yet these resources either are too little used for mathematics education or are used in fragmented ways to maintain less than effective practices. By revising budgetary and administrative regulations for the use of funds in the 1994 reauthorization of ESEA, the federal government sought to create the means for state and local school districts to rethink and reorganize how they use these funds *in conjunction with state and local dollars* to support mathematics and other educational improvement efforts. The Administration's current reauthorization proposal seeks to further strengthen the ESEA legislation in this regard.

With funding from the U.S. Department of Education and the National Science Foundation, a series of district profiles was commissioned and three regional conferences were held to better understand how the new regulations are being applied at the local level to better serve the needs of all students in mathematics education. From these district pro-

[12]See *Exploring Rapid Achievement Gains in North Carolina and Texas* (available at www.negp.gov/reports/grissmer.pdf) and *The Formula for Success: A Business Leader's Guide to Supporting Math and Science Achievement* (available at www.ed.gov/americacounts or www.bcer.org/timss/).

files and the practical wisdom shared at the regional conferences, the following lessons were learned about how districts are improving their coordination of state, local, and federal resources in support of mathematics education.

Chief among the lessons learned was the identification of four overlapping, and often complex, phases related to resource coordination. Additionally, there are essential elements within each phase that we, the authors of this guide, believe are pivotal for improved resource coordination. These phases and elements are summarized in the following table.

Overlapping Phases of Improved Resource Coordination	*Essential Elements in Each Phase*
A shared vision—	• applies to all students; • begins with challenging academic standards; • is established through collaboration; • requires a long-term commitment.
The effective coordination of resources is facilitated by—	• prioritizing needs on the basis of an analysis of appropriate data; • developing a "real" district plan for change; • reorganizing central office staff; • taking full advantage of flexibility in the use of federal funds.
Crucial mechanisms for supporting mathematics improvement at the school level include—	• central office support; • data-informed decision making; • real school improvement plans; • continuous learning.
To sustain mathematics improvement—	• everyone involved in educating children must be accountable for results; • school and district policy must be aligned with high standards and high expectations for all students; • a nurturing and supportive community is essential; • students receive additional support as needed.

The next section of this report gives state and local decision makers and practitioners a suggested framework for analyzing their agencies' coordination efforts in terms of these phases and essential elements.

Moving to Action: A Framework for Self-Assessment

The regional ED/NSF conferences helped us further refine the lessons learned from Horizon Research, Inc.'s district profiles by drawing together state and local education practitioners to discuss their coordination efforts and what contributes to their effectiveness. In the spirit of extending this conversation to other state and local districts that were not represented at the conferences, we developed the following questions to help guide the assessment of your agency's resource coordination efforts.

These questions cannot be answered with a simple yes or no. They require thoughtful consideration of how programs and people are organized to make the best use of all available resources for mathematics improvement. They are not intended to be a checklist. Rather, these questions are intended as a starting point for action-oriented planning conversations, which will lead to improved processes and organizational structures through which state,

local, and federal resources are brought to bear on the improvement of mathematics education programs.

The questions are organized by the phases of resource coordination described earlier in this report, and they touch on the essential elements in each phase. Following the self-assessment questions, we suggest some ideas about whom to involve and how to start the conversation.

Establishing a Shared Vision

1. What constitutes the current vision for mathematics in your state and district? How would someone in your district know what this vision is?
2. How would you describe community support for the vision? How can you nurture and increase support?
3. Does the vision reflect high expectations for the performance of all students as embodied in TIMSS, NAEP, and other challenging benchmarks?
4. What evidence is there that your district expects all students to be mathematically prepared to have the choice to attend a four-year college?

Coordinating Resources

1. What evidence is currently used to determine where your district is relative to its goals and what additional evidence would be helpful?
2. What are the central elements of your district's plan for mathematics improvement?
3. To what extent is your district organized to bring all appropriate resources to bear on mathematics improvement? How can the district's organization be improved?
4. To what extent are you using the new flexibility in federal funding to fund comprehensive mathematics improvement across categorical programs?
5. To what extent does your district ensure that the students in your special programs (including Title I, Special Education, ESL) are being prepared to meet the mathematics goals of your district?

Supporting School Change

1. What do you know about how school administrators and school staff use data to make decisions about the improvement of mathematics programs? What steps could the district take to make the use of data more effective?
2. What evidence do you have that school plans will produce improvement in mathematics achievement?
3. To what extent have you used the latest research on effective professional development to reshape your district's professional-development efforts?
4. What are the primary strategies that the central office is using to support schools' mathematics improvement efforts? What are some additional strategies that would be helpful?
5. If asked, what would school personnel say about the value of central office support for mathematics? What evidence would they use to support their comments?

Sustaining School Improvement

1. How are professional staff in the district and schools held accountable for student performance?
2. How do you use the accountability system to support mathematics improvement efforts?

3. Describe the efforts that your district has made to align policy related to curriculum, instruction, assessment, and professional development to state and local standards. What further work is needed?
4. If your district were to experience a change in leadership, what is the likelihood that mathematics improvement efforts would be sustained? On what evidence did you base your prediction?
5. What efforts has your district made to ensure that every student has access to the support he or she needs to meet the standards?

Who Are the Right People?

It is important to bring together the right people in a state and in local districts to discuss the important challenge of improving mathematics achievement for every student.

At the state level, the "right people" include, at least, the following:

- Chief state school officer or a designee at the next highest level of decision making
- State-level decision makers for all the major funding sources that affect mathematics education, including Title I, Eisenhower, Special Education, Title VI, technology, NSF systemic initiatives, and state compensatory programs
- State mathematics leaders
- Leaders from the major technical assistance providers within the state such as the Eisenhower Regional Consortia for Mathematics and Science, the U.S. Department of Education regional education laboratories, and the Comprehensive Technical Assistance Centers
- Leaders from federal programs and mathematics and administrator professional associations
- Leadership teams from school districts and regional educational service centers

At the district level, the "right people" include, at least, the following:

- Superintendent
- Assistant superintendent for curriculum and instruction
- Local federal program and state compensatory education directors
- Mathematics supervisors
- Principals and teacher leaders (preferably in teams from schools)
- Business and community leaders

Setting mathematics improvement as a priority in the state or district must come from the highest decision-making level, the chief school officer or superintendent, to be effective and sustainable. However, key decision makers at all levels must also understand the priority and its strong implications for their work for the changes to reach deep into the state or district.

How Can You Start the Conversation in Your State or District?

States and districts nationwide are in very different places in the process of improving mathematics achievement for every student. This guide is intended as a resource for helping you determine where your district is in terms of developing a vision, coordinating resources, and supporting schools to improve mathematics education and to address gaps in the existing process.

One conference or meeting will not be enough to make necessary changes in the system to support improving mathematics achievement. We hope that this guide can serve as a useful

starting point, perhaps even as the framework for a kick-off meeting, similar to the regional conferences that preceded the development of this guide. There is something powerful about bringing interested stakeholders and decision makers together to focus on the same issues at the same time. Some ways you might consider doing this follow:

- Work with the regional Eisenhower Consortia and the Comprehensive Technical Assistance Centers to plan state and regional conferences that deepen the conversation about mathematics improvement.
- Get on the agenda of existing state administrator conferences, such as those for Title I administrators, superintendents, and principals, to either begin or continue conversations about making mathematics a priority in statewide improvement efforts.
- Develop or add to listservs, videoconferences, and web sites to engage leaders in ongoing conversations about mathematics improvement, particularly as a follow-up to face-to-face meetings.

To further support the efforts that begin with this guide, additional background readings and references are included in the appendices.

Appendix A
Dispelling the Myths: Background Readings

Title I and Mathematics Instruction: Making the Marriage Work

by Mary Jean LeTendre, Director of Title I programs, Judith Wurtzel, Director of Mathematics Initiative,
Melissa Chabrán and Robin Bouckris, Planning and Evaluation Service,
U.S. Department of Education, 1998

Research shows that the damaging effects of poverty have prevented large numbers of children from succeeding in school, resulting in a large disparity between the performance of children from low-income and higher-income families. Schools with high concentrations of children in poverty face particularly great challenges in educating their students. It is essential, therefore, that federal resources be used to help schools develop comprehensive strategies to improve instructional practices that will benefit students in all academic areas, particularly in reading and mathematics. One of the federal government's most important roles is to lessen the achievement gap that separates students attending high- and low-poverty schools by providing financial assistance to schools to improve the education of disadvantaged children. Title I of the Elementary and Secondary Education Act, which at more than $7 billion is the largest federal investment in K–12 education, provides funding to schools with high concentrations of children from low-income families to support improvements in teaching and learning and to provide services that help disadvantaged children succeed in school.

In the past, Title I and its predecessor Chapter 1 were used by schools to provide targeted, remedial instruction to students. Too often, these programs had low expectations and did little to help children in high-poverty schools meet challenging academic standards. Generally the instruction has not been linked to challenging content and high standards for academic achievement or to schoolwide reform strategies. Moreover, Title I has primarily focused on teaching reading—with inadequate attention given to mathematics.

Today, there is an opportunity to make Title I a key resource in building high-quality mathematics programs. Reauthorization significantly changed the Title I law in 1994. The new law requires that Title I services be linked to the same rigorous content and performance standards that are expected of all children. It also requires that aligned assessments measure students' progress toward these standards and that schools develop schoolwide approaches to improving student performance. About half of the seven million Title I participants are currently receiving assistance in mathematics. These children need Title I services to help them master challenging mathematics content, including the foundations of algebra and geometry by the end of the eighth grade. Developing this mastery means confronting traditional thinking about the uses of Title I to develop a comprehensive strategy for improving mathematics education.

Title I should be used to help districts develop high-quality mathematics programs. Many promising strategies for improving mathematics education exist, but most high-quality programs include high-quality and challenging curriculum and instructional materials, intensive and ongoing professional development, time for planning and collaboration, and the use of mathematics specialists and expert teachers.

Why Now?

The reauthorization of the ESEA in 1994, particularly Title I, placed reaching high standards in reading and mathematics at the center of the program's mission.

- According to the law, each state must have developed or adopted challenging student content and performance standards in at least mathematics and reading/language arts by the beginning of the 1997–98 school year. By the year 2000–01, all states must have final assessments in place to measure students' progress against those performance standards. These must be the same assessments that the state uses to measure the performance of all students.
- The reauthorization lowered the eligibility threshold for Title I schoolwide programs. Schools with at least a 50 percent low-income enrollment may now use their Title I funds (along with other federal, state, and local funds) to improve the entire school's instructional program. This means that services are to benefit all students, especially those not mastering state standards.

These changes require educators to ensure that students receiving Title I services work toward achieving high standards in mathematics as well as in reading. The changes also give schools the flexibility and support to use Title I funds to improve mathematics education for all students.

Using Title I to Support Challenging Mathematics Instruction for All Students

Many strategies are available for effectively using Title I to elevate the quality of mathematics instruction. Below are some questions to stimulate thinking about how to use Title I to support high-quality mathematics teaching and learning. These are questions all educators should ask themselves. Following them are examples of how some schools and districts across the country are using Title I funds to support their efforts to improve mathematics achievement.

Curriculum and Instructional Materials

Common sense and a large body of research suggest that curriculum and instructional materials must be focused and have depth, rigor, and meaning to improve learning in mathematics.

- Do Title I school support teams or your district or school planning teams facilitate access to experts or research findings in mathematics curriculum and instruction?
- Is Title I used to purchase high-quality instructional materials and mathematics curricula that are rigorous, challenging, and research based in your school or district?
- Does Title I support the purchase and effective use of technology in your school or district?
- Does Title I support extended learning time opportunities in mathematics?

Professional Development

Helping teachers who are at various stages of their careers master new content and instructional strategies is essential. If teachers do not understand or cannot use new curricular mate-

rials or instructional approaches, effective change is not possible no matter how high the quality of the tool. A variety of intensive and sustained professional-development experiences can assist teachers and paraprofessionals in acquiring new skills and content knowledge in mathematics. These experiences may include an in-depth study of a mathematical subject, courses in new instructional methods, or training in using information from student assessments to structure instruction.

- Is Title I used to support ongoing professional development in mathematics in your school? Are there opportunities for follow-up activities?
- Are Title I resources coordinated with Title II Eisenhower resources for effective planning?

Time for Planning and Collaboration

Most U.S. teachers have little time during the school day for planning or for collaborative work with their peers. However, some innovative schools in the United States are emphasizing collaboration, flexibility, and professionalism as they experiment with the use of planning time. Ideas include team teaching, back-to-back planning periods, and a shortened day once a week. These options enable teachers to prepare high-quality lessons and to learn from one another. All these activities may be supported by Title I funding. Title I funding can be used to pay teachers for additional planning or observation time. It may also be used to compensate mentor teachers for their additional duties.

Does your school or district use Title I to support

- working with other teachers of mathematics to review and evaluate lesson plans and methods of mathematics instruction?
- observing other teachers in the teaching of mathematics and providing advice and support?
- working with other teachers in reviewing student work in relationship to state or local standards?

Using Mathematics Specialists and Master Teachers

Mathematics specialists and master teachers can assist classroom teachers in a variety of ways. Peer-coaching relationships developed with these experts help teachers develop content knowledge and enrich their instructional strategies.

In your school or district does Title I support

- mathematics specialists who work with teachers to develop their knowledge of mathematics?
- the identification of master mathematics teachers? Do master teachers assist other teachers in planning their lessons, developing instructional strategies, and responding to students with special needs?

Building Partnerships among Schools, Parents, and Communities

Parents and communities are essential partners in the effort to reform mathematics education because they can give students valuable support, guidance, and assistance. Title I can support efforts to disseminate information about mathematics education and to educate parents and communities so they can be effective partners.

- Do you provide parents with information about students' mathematics curriculum, assessments, and expected proficiency levels?
- Do you educate and assist parents so that they can help their children in meeting higher standards in mathematics?

- Do schools in your state or district have parent-school compacts that include a discussion of mathematics education?

Throughout the country, schools and districts are answering "yes" to these questions. Principals, teachers, and students are taking advantage of the possibilities that Title I offers to support high-quality mathematics instruction. The activities in which they are engaged are the types of activities that Title I resources should be supporting. We encourage you as teachers to take this opportunity to begin a dialogue with principals, colleagues, parents, and others about how to use Title I to improve mathematics instruction. Through our joint efforts, we can create the type of learning environment that will enable all children to succeed. We will then be able to meet our nation's goal of being first in the world in mathematics.

Where It's Happening

Reform Efforts in the Memphis Public Schools
Memphis, Tennessee

The goal of school reform in Memphis is to prepare students to be successful workers and citizens in the twenty-first century. As part of that effort, the district is concentrating on improving student achievement in mathematics and science. The district drafted two standards for its mathematics and science curricula: increased student achievement in mathematics and science and increased numbers of students enrolling in high-level mathematics courses (any course beyond first-year algebra) and high-level science courses (any course beyond physical science).

In partnership with the National Science Foundation's Urban Systemic Initiative (USI), Title I has contributed to Memphis City Schools' (MCS) efforts to improve its mathematics and science programs. MCS allocates an instructional facilitator to every Title I schoolwide program. The facilitators serve as lead teachers, supporting classroom instruction and coordinating professional-development opportunities for the school. Title I, in coordination with USI and Title II—the Eisenhower Professional Development Program—provides additional opportunities for professional development for teachers. These opportunities include curriculum workshops and a program that helps teachers assess their beliefs about who can learn higher-level mathematics.

The Title I program supports the district in creating strong student support services for its mathematics and science program. MCS has created Saturday Academies and algebra labs for seventh and eighth graders and has established two summer programs—an Algebra Summer Camp and the Science, Technology, and Algebra Institute. The summer programs promote hands-on learning of mathematics and science through "real world" examples.

Dallas Independent School District
Dallas, Texas

In the Dallas Independent School District (DISD), the Urban Systemic Initiative (USI), with the support of Title I, is implementing a districtwide, standards-based mathematics and science curriculum and developing challenging assessments to measure progress. Specifically, Title I, in collaboration with USI, contributes to these efforts by providing professional development, using innovative materials and technology, and cultivating family and community involvement.

Many schools in DISD are using a portion of their Title I funds to acquire materials for implementing the new mathematics program. Title I and USI also support workshops for teachers on standards-based curriculum alignment and on equity in education for all students. In addition, the district's "Project Seed" program places expert engineers and mathe-

maticians in classrooms to train teachers in lesson modeling and instructional strategies for teaching mathematics. Although the district's Title I program funds the project, USI works closely with Title I staff to train teachers and determine which schools have the greatest need for the assistance.

USI and Title I staff have collaborated to train all teachers in DISD in Family Math and Science, a program that assists teachers in coordinating family mathematics and science nights at their schools. To encourage teachers to implement what they have learned, USI has begun to report the frequency of family nights by school; the reports are later compiled for area superintendents. Another productive collaboration, among Title I, USI, and the DISD instructional technology department, has worked to bring technology to the classroom. Title I and state technology funds support purchasing new computers and training teachers in the use of technology to teach mathematics and science.

In 1998, Dallas students scored all-time highs in mathematics on the Texas Assessment of Academic Skills (TAAS) in five of six grades tested. Mathematics scores showed particularly impressive progress in fourth grade, sixth grade, and eighth grade, where scores improved by nine points, seven points, and twelve points, respectively. Moreover, the achievement gap for African American and Hispanic students continues to decrease. This year 70 percent of Hispanic eighth graders and 78 percent of Hispanic fifth graders passed the TAAS, an increase from 58 and 71 percent passing last year.

Kenton Elementary School
Portland, Oregon

Kenton's curriculum emphasizes interactive writing, vocabulary development, *Math Their Way*, *Every Day Counts*, and *Visual Math*. Kenton teachers use cooperative-learning and peer-tutoring methods and encourage students to analyze and interpret information. Their efforts to improve mathematics instruction show impressive results. The percentage of Kenton third, fourth, and fifth graders who demonstrated that they met state benchmarks on the mathematics portion of the Portland Public Achievement Levels Test increased from 57 percent in 1996–97 to 71 percent in 1997–98.

The decision to jointly hire a mathematics consultant with twelve other schools was crucial to Kenton's efforts. During the 1995–96 school year, the consultant held full-day, weekly workshops on best teaching practices identified by the school principals. The principals developed a regional Title I plan and, with the help of the consultant, brought all staff together to implement the plan. Title I staff instructed regular classroom teachers in new strategies.

Kenton staff agreed to use Title I benchmarks and assessments for all students. All staff meet monthly to share progress on benchmarks and to design intervention plans for students in need. The principal's ownership of the program generates support and constructive evaluation.

Students' families and the community support Kenton. The University of Portland sends student teachers to Kenton and conducts classroom observations. Kenton teachers regularly meet with small groups of students outside of class to give them extra help. The Oregon Children's Foundation sponsored students at a one-week summer camp where they learned computer skills; other programs create parent compacts that involve parents in helping students complete homework. Additionally, teachers train the school's many volunteers to support the benchmarks while working with students. Volunteers trained in the school's goals and plans read with underachieving students twice a week.

Improving America's Schools with Challenging Mathematics (1998)

For more information on improving mathematics education, including a "Self-Assessment Guide for Improving Mathematics: Using Federal Resources for Improving Mathematics Teaching and Learning" see www.ed.gov/americacounts or www.ed.gov/pubs/math/.

Self-Assessment Guide for Improving Mathematics: Using Federal Resources for Improving Mathematics Teaching and Learning

The U.S. Department of Education offers a number of resources to support states and districts in helping students master challenging mathematics. This self-assessment guide is intended to assist administrators in thinking creatively about federal resources along with other state and local sources of support for improving mathematics teaching and learning. The guide highlights significant federal programs and poses questions about how their provisions can apply in the context of helping all students master challenging mathematics, with special attention to Title I, Title II, Title VI, Title VII of the Elementary and Secondary Education Act (ESEA); the Goals 2000: Educate America Act; and the recently reauthorized Individuals with Disabilities Education Act (IDEA). Addressing these with your colleagues, thinking through effective answers, and responding with concrete strategies are essential if we are to achieve the goal that all students master challenging mathematics, including the foundations of algebra and geometry, by the end of the eighth grade.

Promoting Equity and Excellence: High Standards That Apply to *All* Students

	Have Not Considered → *Fully Implemented*
➢ Do you have a plan in your community for ensuring that all students are given the opportunity to meet high-quality state/local standards in mathematics?	☐ ◪ ▬ ◪ ■
➢ Do you know whether your standards in mathematics are "challenging," linked to content and professional development, and clearly articulated both within and across the grade levels? Do you compare them against standards in other districts, states, and nations or against the National Assessment of Educational Progress (NAEP)?	☐ ◪ ▬ ◪ ■
➢ Do you know what percent of fourth through eighth grade students move beyond arithmetic to algebra, geometry, statistics, and data analysis? Do you know what percent of eighth grade students take algebra or other courses that include significant algebraic content?	☐ ◪ ▬ ◪ ■
➢ Do you have indicators to assess how well you are progressing in providing equal access and opportunities in the area of mathematics, particularly across gender and race/ ethnicity, for students with limited English proficiency, and for those with disabilities? (For example, do you examine disaggregated student achievement data to develop your mathematics program? Are materials and assessments modified to foster accommodation when necessary?)	☐ ◪ ▬ ◪ ■

Have Not Considered — *Fully Implemented*

- Do you implement strategies supported through programs such as Goals 2000 and Title I to promote the learning of the fundamentals of mathematics in early childhood programs?
- Do stakeholders (parents, community members, business representatives, classroom teachers, special program teachers, administrators, support staff, and students) understand your state/local standards and the related implications for their work?

Promoting High-Quality Curricula and Instruction

Have Not Considered — *Fully Implemented*

- Do you offer active and effective leadership and administrative support for mathematics education, including coordinating various programs in your state/district?
- Do your state/district improvement plans rely on research on effective strategies for teaching mathematics?
- Do you know whether you have a process for assessing instruction and curriculum implementation and making mid-course corrections?
- Does your mathematics curriculum develop students' understanding of concepts by using multiple representations (concrete, geometrical, graphical, numerical, symbolic)?
- Do teachers of mathematics provide frequent opportunities for students to conjecture, explain, predict, and defend their ideas in a variety of ways?
- Do teachers of mathematics give students opportunities to explore open-ended and nonroutine problems and to experience the power and usefulness of mathematics in the world around them?
- Do you provide support for appropriate textbooks, technology, and other curriculum materials that are focused and rigorous? Have you reviewed the newest National Science Foundation (NSF) curriculum projects?
- Do schools in your state/district ensure that students having difficulty or those needing extra enrichment in mathematics are identified on a timely basis?

Have Not Considered — *Fully Implemented*

- Do schools in your state/district offer any before-or after-school programs or summer school programs in mathematics to give students the extra learning time they may need?

- Do you take advantage of technical assistance from school support teams and from federally funded providers, such as the Comprehensive Centers, Regional Labs, the Eisenhower Consortia, and the Eisenhower National Clearinghouse, to access high-quality information on mathematics teaching and learning?

Professional Development: Promoting High-Quality Teachers

Have Not Considered — *Fully Implemented*

- Do you employ teachers prepared in the content and pedagogy for teaching mathematics well? Do you encourage mathematics specialists and master teachers to assist and mentor other faculty in mathematics instruction?

- Have you aligned teacher licensure, certification, and recertification requirements with state content and performance standards?

- Do you offer active and effective administrative support and encouragement for long-term, ongoing professional-development experiences for teachers?

- Do you use NSF programs, assistance from colleges and universities, and other forms of outside support to support high-quality professional development?

- Do you support or make available professional-development institutes and networks of teachers to enable teachers to communicate with one another and become mathematical thinkers?

- Do you provide time for teachers of mathematics at different grade levels to review, evaluate, and revise the mathematics program to help students meet state/local standards? Do you provide time for teachers to observe one another teach mathematics? Do you provide regular opportunities for teachers to work together in reviewing student work in relationship to state/local standards?

	Have Not Considered				*Fully Implemented*
➢ Do you encourage and support teachers who participate in programs of recognition for excellence (e.g., Distinguished Educators, National Board Certification)?	☐	◪	◨	◪	■
➢ Do you provide both general and special education staff with skills and knowledge that will help them foster the mathematics achievement of students with disabilities?	☐	◪	◨	◪	■
➢ Do you offer professional-development opportunities that promote high-quality mathematics instruction for limited English proficient students?	☐	◪	◨	◪	■

Cultivating Partnerships among Schools, Parents, and Communities

	Have Not Considered				*Fully Implemented*
➢ Do you give parents clear information about students' mathematics curriculum, assessments, and proficiency levels?	☐	◪	◨	◪	■
➢ Do you offer training to help parents assist their children in meeting higher standards in mathematics? (For example, do you disseminate information on the importance of mathematics for attending college and assist parents in understanding new ways of teaching and reinforcing mathematical concepts?)	☐	◪	◨	◪	■
➢ Do schools in your state/district have parent-school compacts that include a discussion of mathematics education?	☐	◪	◨	◪	■
➢ Do you have partnerships with business, industry, and colleges and universities with expertise in mathematics?	☐	◪	◨	◪	■

Coupling Flexibility with Responsibility for Student Performance

	Have Not Considered				*Fully Implemented*
➢ Do you conduct a needs assessment that is specific to mathematics and that is based on student achievement data relative to state/local standards?					
➢ Are assessments of students in mathematics aligned with the goals and objectives of the curriculum and embedded in instruction?					
➢ Do you have improvement targets for student performance in mathematics? Are your schools making progress toward helping students meet state standards in mathematics?					
➢ Do you know how assessments of students in mathematics are used for instructional feedback, analysis of student understanding and progress, diagnosis of student needs, assignment of grades, communication with parents, and curriculum review?					

NOTE: This self-assessment instrument is a work in progress. Feel free to modify it for your own use.

The Use of Title I Resources for High-Quality Mathematics Instruction: Myths and Realities

Myth	*Reality*
➢ **Title I can be used for instruction only in reading or language arts.**	➢ **Title I can be used for instruction in mathematics (and other subjects), including funding Math Specialists.**
➢ **Title I can be used only to support instruction.**	➢ **Title I can be used to support** • **professional development,** • **continuing education for paraprofessionals,** • **upgrading the curriculum,** • **purchasing instructional materials,** • **extending the regular school day, and** • **parent-involvement activities.**
➢ **Professional-development activities funded by Title I or Title II are limited to courses or seminars.**	➢ **Professional-development activities may include time for planning, coordination, observing, networks, and mentoring.**
➢ **Title I cannot support instruction in a subject in which a student is receiving Special Education services.**	➢ **Title I can supplement a student's instruction in any subject–including those subjects for which a student receives Special Education services.**

Tools for Implementing High-Quality Mathematics Instruction

- ➢ **Consolidation of state and local plans**
- ➢ **Consolidation of state and local administrative funds**
- ➢ **New flexibility in using resources**
- ➢ **Expansion of schoolwide programs**

Dispelling the Myths: Background Readings

"Title I and Mathematics Instruction: Making the Marriage Work" by Mary Jean LeTendre, Judy Wurtzel, Melissa Chabran, and Robin Bouckris (pp. 19 to 23)

"Self Assessment Guide for Improving Mathematics: Using Federal Resources for Improving Mathematics Teaching and Learning" (pp. 24 to 28)
Also available at www.ed.gov/americacounts or www.ed.gov/pubs/math/

"The Use of Title I Resources for High-Quality Mathematics Instruction: Myths and Realities"; slide presentation (p. 29)

Coordinating Resources to Support Standards-Based Mathematics Education Programs by Sally L. Bond, Sally E. Boyd, and Diana L. Montgomery
Available at www.horizon-research.com/publications/coord_resources.pdf

Appendix B
Resources to Support Mathematics Education Reform from the Department of Education and National Science Foundation

National Science Foundation Funding Opportunities

The National Science Foundation (NSF) is committed to providing strong and continuing leadership and support for the nation's efforts to improve Science, Mathematics, Engineering and Technology (SMET) education and general scientific and mathematical literacy. Consequently, the Foundation supports programs that are designed to improve the quality of SMET education at all levels.

The Directorate for Education and Human Resources (EHR) has primary responsibility for NSF's educational activities. The programs supported by EHR span preschool through professional levels. Programs include student-centered activities, curriculum and instructional-materials development, informal science education, teacher and faculty enhancement, and comprehensive systemic improvement efforts at the precollege and undergraduate levels. Activities range from programs to improve public science literacy to those designed to enhance the diversity and the preparation of the nation's scientists, mathematicians, and engineers. For the latest information on programs and publications, view www.ehr.nsf.gov/.

Within the Directorate, the Divisions of Elementary, Secondary and Informal Education (ESIE) and of Educational System Reform (ESR) contain the programs with the most direct application to K–12 mathematics improvement projects.

The ESR programs that are open for competition are the Rural Systemic Initiatives in Science, Mathematics, and Technology (RSI) program and the Urban Systemic Program in Science, Mathematics, and Technology Education (USP). The RSI program supports activities that promote systemic reform of science and mathematics education in schools and districts in rural, economically disadvantaged areas. Proposals may be submitted only by institutions of higher education or by nonprofit or governmental organizations on behalf of consortia of school districts and communities representing the educational interests of their students in eligible regions. The USP is a K–12-based program that promotes systemic reform of science and mathematics education for all students. The USP was developed to extend support to urban school districts that have an established infrastructure for change and have begun implementing of systemic reform.

For more information, visit www.ehr.nsf.gov/EHR/ESR/index.htm.

The program within ESIE that is most promising for supporting the work of states, districts, and schools in mathematics improvement is the Teacher Enhancement (TE) program. The categories of TE projects of most applicability are the following.

1. *Leadership Projects* — Through leadership projects, participants can obtain a thorough background in appropriate content and pedagogical knowledge, knowledge of quality instructional materials and educational technologies, knowledge of the process of educational change, and knowledge and skills in leadership.
   a. **Capacity-Building** projects support the development of national, state, and local leaders, as well as professional developers for K–12 science, mathematics, and technology. Participants, drawn from university and college faculty, supervisors in school districts or at the state level, and master teachers, should come to the programs with strong disciplinary expertise.
   b. **Mentor Teacher/Teacher Leaders** projects are intended to develop master teachers and intellectual leaders who have the preparation in content, pedagogy, and assessment necessary to actively support high-quality education. These teachers would take on the additional responsibility of acting as intellectual resources and mentors or supporting their colleagues with the implementation of high-quality instructional materials.
2. *Local Systemic Change (LSC) Projects* — These projects support school systems and their partners (institutions of higher education, professional societies, research laboratories, and so on) in reforming the delivery of science and mathematics education, grades K–12. LSC projects represent a shift in focus from the professional development of individual teachers to that of all teachers in an entire school organization. Although projects must clearly be placed in the context of a comprehensive strategy of reform for grades K–12, they may address a component of that system. For example, an LSC project could target all K–8 teachers of mathematics, all middle school teachers, all high school teachers, or some specific subset. It is expected that the professional-development activities will be designed to support the implementation of instructional materials that have been field tested and shown to be effective. The participating schools are expected to adopt and implement these instructional materials. All teachers in the targeted schools and grade levels are to receive a minimum of 130 hours of professional development.
3. *Technology in Support of Professional Development* — These projects find innovative ways to use educational technologies (e.g., electronic mail, bulletin boards, homepages, electronic conferencing) to provide teachers with the capabilities and support needed to go beyond the typical in-service course. It is expected that these projects will create a culture of learning in which teachers can share ideas, draw freely on the expertise of their colleagues, and gain access to current information and thinking. Teachers should learn how to individualize instruction through the use of modeling and other pedagogical strategies that are made available through advances in technology. Opportunities and resources should be extended to isolated schools and teachers through telecommunications.

Preliminary proposals are required in the TE program and should be sent no later than 1 April each year. Full proposals must be postmarked by 25 August each year.

ESIE also supports special categories of full proposals in two areas that are particularly suited to support grants to educators seeking to plan and bring together the expertise necessary to develop strategies to effectively coordinate resources in support of mathematics education improvement. These proposals may be submitted at any time and do not require the prior submission of a preliminary proposal. As in all proposals, however, prior discussion with the appropriate program officer is encouraged and helpful.

- Planning Grants: Planning Grants are generally intended for groups that need additional resources to develop essential areas of a project. Such groups may include those who have been underrepresented in SMET education activities (e.g. minorities, women, persons with disabilities), new performers, or applicants attempting to coordinate the activities of large and complicated systems or develop large-scale leader-

ship activities. The award typically does not exceed $50,000 and has a duration of two years. Planning grants can be used for the type of efforts described in this report.

- Grants for Conferences, Symposia, and Workshops: NSF supports conferences, symposia, and workshops to assemble experts for the purposes of discussing recent research or education findings, exposing others to new research and education techniques, and developing action plans.

For more information about ESIE programs, see the division's "Program Announcements and Guidelines" at www.ehr.nsf.gov/EHR/ESIE/index.html or call (703) 306-1620.

U.S. Department of Education Funding Opportunities

America Counts, the Department's mathematics initiative, has six strategic goals: (1) equip teachers to teach challenging mathematics through high-quality preparation and ongoing professional growth; (2) provide personal attention and additional learning time for students; (3) support high-quality research to support best practices in mathematics teaching and learning; (4) build widespread public understanding of the mathematics that today's students must master; (5) encourage a challenging and engaging curriculum for all students that is based on rigorous standards; and (6) promote the coordinated and effective use of federal, state, and local resources. For more information about America Counts, go to www.ed.gov/americacounts.

In support of the aims of America Counts, the U.S. Department of Education provides both formula and competitive grants that assist states and schools in their efforts to reach the goal of providing high-quality mathematics education for all students. Several programs have particular relevance to the efforts to educators seeking to better coordinate resources in support of improved mathematics education.

Title I of the Elementary and Secondary Education Act

The Title I program is the federal government's largest program that supports elementary and secondary education. Title I provides funds to help low-achieving children, particularly those in high-poverty schools, learn to high standards. Title I can give disadvantaged children the benefit of, for example, more individualized and accelerated instruction; extended-day programs; and learning laboratories in mathematics, science, and computers. Title I emphasizes holding students participating in Title I to the same high standard as all students. Moreover, it promotes schoolwide reform by allowing schools that serve an area in which the percentage of children living in poverty exceeds 50 percent to use their Title I funds, in combination with other federal, state, and local funds, to upgrade the school's entire instructional program. Other schools use the money to help those children most in need of supplementary services. In addition, the Title I statute emphasizes the professional development of educators; every local educational agency participating in the Title I program must provide high-quality professional development, geared to challenging state standards, to improve the teaching of academic subjects. For more information on Title I, contact the Office of Compensatory Education Programs at (202) 260-0826 or go to www.ed.gov/offices/OESE.

Eisenhower Professional Development State Grants

(Title II of the Elementary and Secondary Education Act). Title II supports a wide array of professional-development activities that are tied to challenging state content standards and are of sufficient intensity and duration to have a positive and lasting impact on teachers' classroom performance. By statute, at least $250 million of the Eisenhower funds must be spent on professional development in mathematics and science. The strengths of the program include its reach—funds flow to states and school districts by formula, and the

vast majority of local educational agencies participate—and the flexibility it gives state and local administrators to carry out program activities that meet particular state and local needs. For more information on Title II, contact program staff at (202) 260-2465 or go to www.ed.gov/offices/OESE.

The President's Teacher-Quality Initiative

This program helps fund the recruitment, preparation, and induction of the estimated 2.2 million new teachers who will be hired over the next decade, many of whom will teach some level of mathematics. For more information contact Ed Crowe at (202)260-8460, or Louis Venuto at (202)708-8847, or go to www.ed.gov/offices/ope/heatqp.

The Comprehensive School Reform Demonstration Program (CSRD)

New in 1998, CSRD is helping to raise student achievement by assisting public schools across the country to implement effective, comprehensive school reforms that are based on reliable research and effective practices; that cover virtually all aspects of a school's operations, including curriculum and instruction, student assessment, teacher professional development, parent involvement, and school management; and that use high-quality assistance from outside partners experienced in schoolwide reform. Funds are available to support schools, especially high-poverty schools, in making schoolwide improvements in mathematics and reading as well as in other areas of identified need. Through CSRD, schools receive grants from their states to adopt comprehensive reforms to help students meet challenging state and local standards in mathematics, reading, and other core academic areas. For more information, visit the CSRD Program Web site at www.ed.gov/offices/OESE/compreform. To contact the CSRD staff, call (202) 205-4292 or send e-mail to compreform@ed.gov.

Math Tutoring through Federal Work-Study

To encourage colleges and universities to support mathematics tutoring, effective 1 July 1999, the federal government will pay 100 percent of the wages of work-study students who serve as mathematics tutors to elementary through ninth-grade students. The work-study waiver enables college students who have an affinity for mathematics and science to gain valuable work experience as tutors while taking an active role in helping students prepare rigorous college-preparatory mathematics courses in high school. To learn more about this effort, see "Mathematics Tutoring and Mentoring" at www.ed.gov/americacounts.

Gear Up

To encourage more low-income students to stay in school, study hard, and prepare for college, this new competitive-grants program supports early college-awareness activities at both local and state levels. Gear Up supplies $120 million for multiyear grants to locally designed partnerships between colleges and high-poverty middle schools, plus at least two other partners—such as community organizations, businesses, religious groups, state education agencies, parent groups, or nonprofit organizations. Competitive applications will include strong mathematics components. For more information, go to www.ed.gov/gearup/.

21st Century Community Learning Centers (CCLCs)

To keep children safe and to give them extended learning opportunities, including mathematics instruction and enrichment, this initiative funds after-school programs in rural and inner-city schools. For more information, go to www.ed.gov/offices/OERI/21stCCLC.

Appendix C
Federally Funded
Technical Assistance Providers

Implementation Centers

The National Science Foundation has funded several implementation centers to provide information about the mathematics instructional materials developed with NSF funding and to help teachers and school administrators understand the issues related to the implementation of these materials.

The K–12 Mathematics Curriculum Center

The K–12 Mathematics Curriculum Center at the Education Development Center, Inc., in Newton, Massachusetts has the mission of supporting school districts as they select and implement curriculum materials developed in response to the National Council of Teachers of Mathematics' *Curriculum and Evaluation Standards for School Mathematics*. The Center provides a series of seminars, resource guides, cases and other written material, referrals, and phone consultations to help facilitate a discussion of the issues and decision making among the stakeholders within a school district. Phone 800-332-2429, or visit www.edc.org/mcc.

Show-Me Center

The Show-Me Center at the University of Missouri at Columbia, in partnership with five NSF-funded middle grades curriculum-development projects and their publishers, provides information and resources to support selecting and implementing middle grades mathematics curricula that embody the vision of the National Council of Teachers of Mathematics as outlined in their Standards documents. The center and its partners provide general information about the five NSF-sponsored middle school curricula; sponsor conferences showcasing the curricula and establishing an ongoing dialogue about important issues related to learning, teaching, and assessing middle-grades mathematics; maintain a web site to allow a broad range of people to explore the five NSF-funded middle-grades mathematics curricula; and provide information on professional-development activities for teachers preparing for standards-based mathematics curriculum reform at the middle grades. For more information, phone 573-884-2099, or visit http://showmecenter.missouri.edu/.

Two other implementation centers support elementary school and high school mathematics instructional materials with a structure and services similar to those of the Show-Me Center. The center for elementary school materials is the **ARC Center** at the Consortium for Mathematics and Its Applications in Lexington, Massachusetts, phone 781-862-7878, Ext. 50, or visit http://comap.com/arc. The center for high school materials is **COMPASS** at Ithaca College in Ithaca, New York, phone 800-688-1829, or visit http://www.ithaca.edu/compass.

Eisenhower Regional Consortia

The ten regional consortia help identify and disseminate promising and exemplary mathematics and science instructional materials, provide technical assistance in implementing teaching methods and assessment tools for K–12, and collaborate with other organizations engaged in mathematics and science education improvement. For more information on how to contact the consortium that serves your community, go to www.ed.gov/offices/OERI/ORAD/math.html.

Comprehensive Regional Assistance Centers

The fifteen Comprehensive Centers are part of an emerging network of organizations offering assistance and information nationwide. Their role in this network is to help states, school districts, and schools meet the needs of children served under Title XIII of ESEA. The comprehensive centers focus on two priorities, as required by ESEA: assisting Title I schoolwide programs and helping local education agencies—and schools funded by the Bureau of Indian Affairs—that have the highest percentages or numbers of children in poverty. For more information on the comprehensive center in your region, go to www.ed.gov/EdRes/EdFed/EdTechCtrs.html.

The Eisenhower National Clearinghouse (ENC)

The clearinghouse identifies effective curriculum resources, creates high-quality professional-development materials, and collects and disseminates all useful information and products in support of K–12 mathematics and science teaching and learning. ENC resources include a new Web Site, Teacher Change: Improving K–12 Mathematics, which offers professional-development workshop activities, full text journal articles about teacher change, teacher narratives, and materials from TIMSS. For more information, go to www.enc.org.

Appendix D
ADDITIONAL USEFUL RESOURCES

U.S. Department of Education Publications and Web Sites

Unless otherwise noted, publications of the U.S. Department of Education can be ordered by calling (877) 4ED-PUBS or sending e-mail to edpubs@inet.ed.gov. To view documents, go to www.ed.gov/americacounts.

Learning from Assessment

This publication is a professional-development tool that uses assessment items and examples of student work to better understand mathematics standards.

Improving Mathematics in Middle School: Lessons from TIMSS and Related Research

This publication synthesizes for policymakers and the public lessons learned from TIMSS and other research about student achievement, curriculum content, and teaching.

Mathematics Equals Opportunity

This analysis shows that high school students who take algebra, geometry, and other rigorous mathematics courses are more likely to go to college. This is particularly true of students from low-income communities.

The Formula for Success: A Business Leader's Guide

U.S. business leaders are increasingly aware that most students leaving school do not possess the necessary skills to succeed in their industry. This publication promotes involvement strategies for business leaders and encourages them to actively participate in improving mathematics and science achievement in schools.

Attaining Excellence: A TIMSS Resource Kit

This kit translates the Third International Mathematics and Science Study (TIMSS) findings into a format that helps foster discussions on ways to improve mathematics curricula and instruction. To order, call (202)512-1800 or send e-mail to orders@gpo.gov.

Internet-Based Materials

The Federal Resources for Educational Excellence (FREE) Web site connects teachers, students, and parents to instructional and learning materials in mathematics and science from more than forty federal agencies. To access, go to www.ed.gov/free.

Gateway to Educational Materials (GEM)

This Web site is essential to one-stop access to educational resources on the Internet, providing links to collections of educational materials—including mathematics—found on various federal, state, university, nonprofit, and commercial Internet sites. To access, go to www.ed.gov/NLE/gem.html.

Selected Additional Publications and Web Sites

Ideas That Work: Mathematics Professional Development

This Eisenhower National Clearinghouse publication describes fifteen core professional-development strategies for mathematics teachers and provides examples of successful programs that exemplify each strategy. A similar publication is also available for science professional development. To order, call (800) 621-5785, or send e-mail to editor@enc.org.

Every Child Mathematically Proficient: An Action Plan

The Learning First Alliance, a coalition of twelve of the nation's leading elementary and secondary education associations, has issued an Action Plan to bring U.S. students to world class levels in mathematics. The document targets strategies for change in curriculum and assessment, professional development of teachers, public awareness and support, and research and development. It is available at www.learningfirst.org.

Exploring Rapid Achievement Gains in North Carolina and Texas

North Carolina and Texas produced the largest average gains in the nation on NAEP reading and mathematics assessments administered between 1990 and 1996. This study, done for the National Education Goals Panel by David Grissmer and Ann Flanagan, reports on case studies in both states that seek to identify the policy initiatives and policy environments that plausibly account for those gains. To view this document, go to www.negp.gov.

Resources for Mathematics Improvement

The Charles A. Dana Center at the University of Texas at Austin conducts applied research, develops educational resources, provides technical assistance, and convenes individuals and groups to work together to improve Texas education. The Dana Center houses the Texas Statewide Systemic Initiative in Mathematics, Science and Technology Education and the Texas Comprehensive Technical Assistance Center for Federal Programs. Many of the Dana Center's products and resources are relevant nationally, as well as in the state of Texas. To access the center's mathematics and science resources, visit their Web site at www-tenet.cc.utexas.edu/ssi/.

NSF 00-83